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• Industry standard footprint
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• 90% to 110% output trim
• No minimum load
• Overvoltage protection
• Remote ON/OFF
• Available RoHS compliant

1. Introduction
This application note describes the features and functions of Artesyn Technologies’ EXQ125 series of high power density, quarter-brick dc-dc converters. These open-frame, single-output modules are targeted specifically at the fixed and mobile telecommunications, industrial electronics and distributed power markets.

All EXQ125 series converters offer a wide input voltage range of 33 Vdc to 75 Vdc and feature a wide baseplate operating temperature range of -40 °C to +100 °C. Ultra-high efficiency operation is achieved through the use of proprietary synchronous rectification and control techniques. The modules are fully protected against overcurrent, overvoltage and overtemperature conditions. Standard features include Remote ON/OFF and remote sense.

The EXQ125 series is designed primarily for telecommunication applications and complies with ETS 300 386-1 immunity and emission standards for high priority of service class. In addition, the series complies with ETS 300 019-1-3/-2-3 environmental standards (all classes) including shock, vibration, humidity and thermal performance. EN60950 and UL/cUL1950 safety approvals have been obtained, and a high level of reliability has been designed into all models through extensive use of conservative de-rating criteria. Automated manufacturing methods, together with an extensive qualification program, ensure that all EXQ125 series converters are produced to the same rigorous quality levels.

2. Models
The EXQ125 series comprises seven models, as listed in Table 1.

<table>
<thead>
<tr>
<th>Model</th>
<th>Input Voltage</th>
<th>Output Voltage</th>
<th>Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXQ125-48S1V2J</td>
<td>33-75 Vdc</td>
<td>1.2 V</td>
<td>30 A</td>
</tr>
<tr>
<td>EXQ125-48S1V5J</td>
<td>33-75 Vdc</td>
<td>1.5 V</td>
<td>30 A</td>
</tr>
<tr>
<td>EXQ125-48S1V8J</td>
<td>33-75 Vdc</td>
<td>1.8 V</td>
<td>30 A</td>
</tr>
<tr>
<td>EXQ125-48S2V5J</td>
<td>33-75 Vdc</td>
<td>2.5 V</td>
<td>30 A</td>
</tr>
<tr>
<td>EXQ125-48S3V3J</td>
<td>33-75 Vdc</td>
<td>3.3 V</td>
<td>25 A</td>
</tr>
<tr>
<td>EXQ125-48S05J</td>
<td>33-75 Vdc</td>
<td>5.0 V</td>
<td>20 A</td>
</tr>
<tr>
<td>EXQ125-48S12J</td>
<td>33-75 Vdc</td>
<td>12.0 V</td>
<td>8.3 A</td>
</tr>
</tbody>
</table>

Table 1 - EXQ125 Models

3. General Description
3.1 Electrical Description
A block diagram of the EXQ125 converter is shown in Figure 1. Extremely high efficiency power conversion is achieved through the use of synchronous rectification techniques [patents pending].

The EXQ125 is implemented using a current-mode controlled interleaved flyback topology. Power is transferred magnetically across the isolation barrier via isolating power transformers. In all models, the secondary-side rectification stage consists of synchronous rectifiers controlled by proprietary circuitry to optimize the timing which is critical for high efficiency power conversion. The regulated voltage on the output pins is governed by the voltage sensed at the module’s sense pins, V\textsubscript{sense+} and V\textsubscript{sense-}.

The output is adjustable over a range of 90% to 110% of the nominal output voltage, using the TRIM pin which is referenced to V\textsubscript{sense-}.

The converter can be shut down via a Remote ON/OFF input that is referenced to the primary side. The input is compatible with popular logic devices; a ‘positive’ logic input is supplied as standard, with ‘negative’ logic available as an option. Positive logic implies that the converter is enabled if the Remote ON/OFF input is high (or floating) and disabled if it is low. Conversely, negative logic implies that the converter is enabled if the Remote ON/OFF input is low, and disabled if it is high (or floating).

The output is monitored for over-voltage conditions. The converter will clamp at the over-voltage set-point if an over-voltage condition caused by an internal fault is detected at the output.

The converter is also protected against over-temperature conditions. If the converter is overloaded or the baseplate temperature gets too high, the converter will shut down until the temperature falls below a minimum threshold. There is a thermal hysteresis of typically 3 °C to 5 °C, to protect the unit.

An internal second-order input filter (LC) smoothes the input current and reduces conducted and radiated EMI. Further improvement can be achieved through the use of an optional external input filter. See section 6.1 for further details.
3.2 Physical Construction

The EXQ125 is constructed using a multi-layer FR4 PCB and an insulated metal substrate (IMS). SMT power components are placed on one side of the IMS while low power control components are placed on both sides of the PCB. This approach optimizes heat dissipation of the power components mounted on the baseplate, and also thermally isolates the critical control components.

The converter is an open-frame product and has no case or case pin. The open-frame design has several advantages over encapsulated closed devices, including:

- **Cost**: no potting compound, case or associated process costs involved
- **Thermals**: the heat is removed from the heat-generating components without heating more sensitive, less tolerant components such as opto-couplers
- **Environmental**: some encapsulants are not kind to the environment and create problems in incinerators. Furthermore, open-frame converters are more easily re-cycled
- **Reliability**: open-frame modules are more reliable for a number of reasons, including improved thermal performance and reduced thermal coefficient of expansion (TCE) stresses

A separate paper discussing the benefits of open-frame DC/DC converters (Design Note 102) is available at www.artesyn.com.

### 4. Features and Functions

#### 4.1 Wide Operating Temperature Range

The wide ambient operating temperature range of the EXQ125 module is a result of its extremely high power conversion efficiency and resultant low power dissipation, combined with the excellent thermal performance of its IMS. The maximum output power that the module can deliver depends on a number of parameters, primarily:

- Input voltage range of target application
- Output load current of target application
- Air velocity (if used in a forced convection environment)
- Mounting orientation of target application PCB, i.e. vertical/horizontal mount, or mechanically tied down (especially important in natural convection conditions)
- Target application PCB design, especially with respect to ground planes, which can provide effective heatsinks for the converter

The converter can be operated from -40 °C to a maximum baseplate temperature of +100 °C. A number of design graphs are included in the longform datasheet that simplify the design task and allow the power system designer to determine the maximum output current at which the EXQ125 module may be operated for a given baseplate temperature and airflow.

#### 4.2 Over-Temperature Protection

All EXQ125 converters feature non-latching over-temperature protection. The temperature of the main substrate is monitored by a sensor. If the temperature exceeds a threshold of 115 °C (typical) the converter will shut down, disabling the output. When the substrate temperature has decreased by between 3 °C and 5 °C, the converter will automatically restart.

The converter might experience overtemperature conditions during a persistent overload on the output. Overload conditions can be caused by external faults. OTP might also be entered due to a loss of control of the environmental conditions (e.g. an increase in the converter’s temperature due to a failing fan).

#### 4.3 Output Voltage Adjustment

The output voltage on all models is trimmable by -10% to +10% of the nominal output voltage. Details on how to trim all models are provided in section 8.4.

#### 4.4 Output Overvoltage Protection

The clamped overvoltage protection (OVP) feature is used to protect the module and the user’s circuitry in the unlikely event of a fault occurring in the main control loop. Faults of this type include optocoupler failure, an open-circuit sense resistor or error amplifier failure. The unit is also protected in the event of the output being trimmed above the recommended maximum specification.

The OVP circuit consists of an auxiliary control loop running in parallel to the main control loop. However, unlike the main loop, the OVP loop senses the voltage at the output power terminals of the module. The sensed voltage is compared to a separate OVP reference, and a compensated error signal is generated such that the output voltage is regulated to the OVP clamp level. Note that an optocoupler is not required during operation of the OVP clamp circuit. OVP clamp levels are typically set at 120-125% of the nominal output voltage setpoint for all models.

#### 4.5 Safe Operating Area

The Safe Operating Area (SOA) of the EXQ125 converter is shown in Figure 2. Assuming the converter is operated within its thermal constraints, it can deliver an output current \( I_{O,\text{max}} \) as shown in Figure 2. Note, however, that the SOA does not remain valid across the full trim range of the converter. For example, if the unit is trimmed up by 10%, the output current must be correspondingly derated by 10%. The module can still deliver \( I_{O,\text{max}} \) when trimmed down.
4.6 Brickwall Current Limit and Short-Circuit Protection

All EXQ125 models have a built in brickwall current limit function and full continuous short-circuit protection. Thus the V-I characteristic in current limit, as indicated by the dashed line in Figure 2, will be almost vertical at the current limit inception point, $I_{o,\text{CL}}$. This means that the output current should be almost constant, irrespective of the output voltage during overload. The current limit inception point is dependent upon baseplate temperature and line voltage, and also has a parametric spread. For all models, the inception point is typically 115% of rated full load. The brickwall current limit scheme has many advantages, including increased capacitive load start-up capability (see section 8.6).

Note that although none of the module specifications is guaranteed when the unit is operated in an overcurrent condition, the unit will not be damaged, because it will be protected by the OTP function.

4.7 Remote ON/OFF

The Remote ON/OFF input allows external circuitry to put the EXQ125 converter into a low dissipation sleep mode. Active-high Remote ON/OFF is available as standard and active-low logic can be specified as an option by adding the suffix '-R' to the part number.

Active-high units of the EXQ125 series are turned on if the Remote ON/OFF pin is high (or left floating). Pulling the pin low will turn the unit off. Active-low units are turned on if the Remote ON/OFF pin is low. Pulling the pin high (or leaving it floating) will turn the unit off. The signal level of the Remote ON/OFF input is defined with respect to $V_{\text{IN}}$.

To simplify the design of the external control circuit, logic signal thresholds are specified over the full temperature range. The maximum Remote ON/OFF input open-circuit voltage, as well as the acceptable leakage currents, are specified in the EXQ125 longform datasheet.

The Remote ON/OFF input can be driven in a variety of ways as shown in Figures 3, 4 and 5. If the Remote ON/OFF signal originates on the primary side, the Remote ON/OFF input can be driven through a discrete device (e.g. a bipolar signal transistor) or directly from a logic gate output. The output of the logic gate can be an open-collector (or open-drain) device. If the drive signal originates on the secondary side, the Remote ON/OFF input can be isolated and driven through an optocoupler.
5. Safety

5.1 Electrical Isolation
The EXQ125 has been submitted to independent safety agencies and has EN60950 and UL1950 safety approvals. Operational insulation is provided between the input and output of the dc-dc power module in accordance with EN60950. The module should be installed in end-use equipment in compliance with the requirements of the application and is intended to be supplied by an isolated secondary circuit. It has been judged on the basis of the required spacings in the Standard of Safety and Information Technology Equipment, electrical business equipment, No. 950 UL1950, third edition, including revisions through revision date March 1, 1998, which are based on the fourth amendment to EN60950, second edition, sub-clause 2.9 for use in the United States and Canada.

When the supply to the dc-dc power module meets all the requirements for SELV (<60 Vdc), the output is considered to remain within SELV limits and not at hazardous energy levels. If connected to a 60 Vdc power system, reinforced insulation must be provided in the power supply that isolates the input from the mains.

The galvanic isolation is verified in an electric strength test in production; the test voltage between input and output is 1.5 kVdc. Also, note that flammability ratings of the terminal support header blocks and internal plastic constructions meet UL94V-0.

5.2 Input Fusing
The EXQ125 power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of a sophisticated distributed power architecture. To preserve maximum flexibility, internal fusing is not included. However, in order to comply with safety requirements, the user must provide a fuse in the unearthed input line if an earthed input is used. The reason for putting the fuse in the unearthed line is to avoid earth being disconnected in the event of a failure. If an earthed input is not being used, the fuse can be placed in either input line. The recommended fuse rating for the EXQ125 converter is 5 A, HRC (high rupture capacity), anti-surge, rated for 200 V. This fuse was selected to meet safety agency approval for abnormal testing. A fuse should be used at the input of each EXQ125 module. If a fault occurs in the module such that the input source is shorted, the fuse will provide the following two functions:

• Isolate the failed module from the input supply bus, in order that the remainder of the system can continue operating
• Protect the distribution wiring from overheating

Based on the information provided in the long-form data sheet on inrush energy and maximum dc input current, the same type of fuse with a lower rating can be used, depending on the model. Refer to the fuse manufacturer’s data for further information.

6. EMC
The EXQ125 is designed to comply with the EMC requirements of ETSI 300 386-1. It meets the most stringent requirements of Table 5; ‘public telecommunications equipment, locations other than telecommunication centres, high priority of service’. The following sections detail the list of standards which apply and with which the product complies.

Conducted Emissions
The applicable standard for conducted emissions is EN55022 (FCC Part 15). Conducted noise can appear as both differential-mode and common-mode noise currents. Differential-mode noise is measured between the two input lines, with the major components occurring at the converter’s fundamental switching frequency and its harmonics. Common-mode noise, generated in switching converters, can contribute to both radiated emissions and input conducted emissions; it is measured between the input lines and system ground, and can be broadband in nature. The EXQ125 series of converters bypasses common-mode noise internally by using two paralleled 1 nf, 2 kV capacitors between V_in and V_out. Common-mode noise currents flowing in the application circuitry will therefore be minimized. Furthermore, the EXQ125 has a substantial second-order differential-mode filter on board, to enable it to meet the above standard using a simple externally connected differential- and common-mode filter. The circuit diagram of the filter required for Class B compliance is presented Figure 6. A similar filter can be derived for Class A compliance using the same component set.

Differential-mode noise is attenuated by a π-filter comprised of the series inductance presented by the leakage inductance of the common mode choke, L_{x1}, and the X-capacitors, C_{x1} and C_{x2}. The converter side capacitor is typically an electrolytic with a relatively significant ESR component that helps maintain input system stability.

The common-mode noise filter comprises the Y-capacitors, C_{y1} and C_{y2}, from each input line to a chassis ground plane, capacitors C_{y3} and C_{y4} from each output line to the ground plane and the common-mode choke, L_{x1}. The ground plane can be connected to the case when case tie-downs are employed. Resistors R_{y1} and R_{y2} help damp any oscillation occurring between the common mode filter inductance and Y-capacitance.

Figure 6 - Recommended Filter for Class B Compliance
The components used in the filter shown in Figure 6, together with the manufacturers’ part numbers for these components, are as follows:

- \( C_{x1} \): ITW Paktron 4 µF, 100 V, SMT film capacitor, 405K100CS4
- \( C_{x2} \): UCC 33 µF, 100 V, electrolytic capacitor, KMF100V333RM10X12
- \( C_{y1}, C_{y2} \): 2 x AVX 5.6 nF, 1.5 kV, 1812SC562KA1
- \( C_{y3}, C_{y4} \): 2 x AVX 0.1 µF, 100 V, 12061C104KAT
- \( R_{y1}, R_{y2} \): 2 x 5.6 Ω 1206 resistor
- \( L_{x1} \): Pulse Eng PO420

General recommended layout guidelines of the specified filter are shown in Figure 7. Section 8.1 discusses this subject in more detail, particularly with reference to safety-related creepage and clearance requirements.

Typical conducted emission measurement results are shown in Figure 8. The results were obtained using the recommended external Class B input filter as outlined in Figure 6.

6.2 Radiated Emissions

The applicable standard is EN55022 Class B (FCC Part 15). Testing dc-dc converters as a stand-alone component to the exact requirements of EN55022 is very difficult, because the standard calls for 1 m leads to be attached to the input and output ports and aligned such as to maximize the disturbance. In such a set-up, it is possible to form a perfect dipole antenna that very few dc-dc converters could pass.

However, the standard also states that ‘An attempt should be made to maximize the disturbance consistent with the typical application by varying the configuration of the test sample’. In addition, ETS 300 386-1 states that the testing should be carried out on the enclosure. The EXQ125 is primarily intended for PCB mounting in telecommunication rack systems. Signal input lines to the converter are considered to be less than 3 meters in length to meet the standards.

For the purpose of the radiated test, an EXQ125 was mounted on a 6U high test-board using the recommended PCB layout (see Appendix 1). The operating conditions were:

- Input voltage, \( V_i = 48 \) V
- Output voltage, \( V_o = 3.3 \) V
- Output current, \( I_o = 25 \) A
- Baseplate temperature, \( T_{baseplate} = 25 \) °C

No enclosure was used. Emission levels were within Class B specification.
8. Applications

8.1 Optimum PCB Layout

The PCB acts as a heatsink and draws heat from the unit via conduction through the pins and radiation. It is recommended that power and return planes be used. A three-wire system including a chassis or system ground is also possible, and a ground plane here is also beneficial. These planes act as EMC shields (note that the recommended layout shown in Figure 7 does not guarantee system EMC compliance, since this depends on the end application). A recommended layout for an end-user’s double sided PCB, which maintains the creepage and clearance requirements discussed in the safety section of this application note, is presented in Appendix 1. However, the end-user must ensure that other components and metal in the vicinity of the EXQ125 meet the spacing requirements to which the system is approved. Low resistance and low inductance PCB layout traces should be used where possible, particularly where high currents are flowing (such as on the output side).

8.2 Optimum Thermal Performance

The maximum acceptable baseplate temperature for EXQ125 converters is +100 °C, as measured at the thermal reference point shown in Figure 9.

To simplify the thermal design task a number of graphs are given in the data sheet and are repeated here in Figures 10, 11, 12, 13, 14, 15 and 16. The set of derating graphs show the load current of EXQ125 converters versus the ambient air temperature and forced air velocity. However, since the thermal performance is heavily

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time</th>
<th>Temperature Ramp</th>
</tr>
</thead>
<tbody>
<tr>
<td>260 °C±5 °C</td>
<td>10 sec±1</td>
<td>Preheat 4 °C/sec to 160 °C, 25 mm/sec rate</td>
</tr>
</tbody>
</table>

Table 2 - Wave Solder Test Conditions
dependent upon the final system application, the user needs to ensure that the baseplate is kept within its recommended temperature rating. It is recommended that the temperature of the baseplate is measured using a thermocouple or an IR camera. In order to comply with the inherent stringent Artesyn derating criteria the baseplate temperature should never exceed +100 °C.

Figure 10 - Maximum Output Current vs. Ambient Temperature and Airflow for EXQ125-48S12J Model

Figure 11 - Maximum Output Current vs. Ambient Temperature and Airflow for EXQ125-48S05J Model

Figure 12 - Maximum Output Current vs. Ambient Temperature and Airflow for EXQ125-48S3V3J Model

Figure 13 - Maximum Output Current vs. Ambient Temperature and Airflow for EXQ125-48S2V5J Model

Figure 14 - Maximum Output Current vs. Ambient Temperature and Airflow for EXQ125-48S1V8J Model

Figure 15 - Maximum Output Current vs. Ambient Temperature and Airflow for EXQ125-48S1V5J Model
8.3 Remote Sense Compensation

The remote sense compensation feature minimizes the effects of resistance in the distribution system and facilitates accurate voltage regulation at the load terminals or other selected point. The remote sense lines will carry very little current and hence do not require a large cross-sectional area. However, if the sense lines are routed on a PCB, they should be located close to a ground plane in order to minimize any noise coupled onto the lines that might impair control loop stability. A small 100 nF ceramic capacitor can be connected at the point of load to decouple any noise on the sense wires. The module will compensate for a maximum drop of 10% of the nominal output voltage. However, if the unit if already trimmed up, the available remote sense compensation range will be correspondingly reduced. Remember that when using remote sense compensation, all the resistance, parasitic inductance and capacitance of the distribution system are incorporated within the feedback loop of the power module. This can have an effect on the module compensation, affecting the stability and dynamic response.

8.4 Output Voltage Adjustment

The output can be externally trimmed by ±10% by connecting an external resistor between the TRIM pin and either the Vsense+ or Vsense− pin. With an external resistor between TRIM and Vsense−, Rtrim_down, the output voltage set-point decreases. Conversely, connecting an external resistor between TRIM and Vsense+, Rtrim_up, will increase the output voltage set-point. A trim potentiometer with its terminals connected to the positive and negative sense pins and the wiper connected to the trim pin allows a variable trim, either up or down. This is shown in Figures 17, 18 and 19.
The relevant trim equations to derive the appropriate trim resistance for the EXQ125 are as follows:

$$R_{\text{trim\_down}} = \left( \frac{511}{\Delta\%} - 10.22 \right) \Omega$$

$$R_{\text{trim\_up}} = \left( \frac{5.11 \times V_{\text{out}} (100 + \Delta\%)}{V_{\text{ref}} \Delta\%} - \frac{511}{\Delta\%} - 10.22 \right) \Omega$$

where $V_{\text{ref}} = 1.225 \text{ V}$ for all models with $V_{\text{out}} > 1.2 \text{ V}$ and $V_{\text{ref}} = 0.6125 \text{ V}$ for the model with $V_{\text{out}} = 1.2 \text{ V}$. $\Delta\%$ is the percentage output voltage change. $\Delta\%$ is always positive regardless of the direction of trim. For example a 5% trim down, $\Delta\% = 5$.

The above trim equations are considered the ‘industry standard’ trim equations for single output ‘quarter brick’ dc-dc converters.

Alternatively, a voltage source applied between the TRIM pin and $V_{\text{sense}}$ can be used to trim up or down above or below the nominal output voltage. The voltage source applied to the TRIM pin for a certain trim level is defined in Figure 23. Note that when the module is trimmed down below the recommended level of 10%, the control circuit bias voltage supply circuit draws current directly from the line. Such a dissipative supply mode will cause the bias supply to eventually overheat and trip the OTP circuit.

When the output voltage is trimmed up a certain percentage, the output current must be de-rated by the same amount so that the maximum output power is not exceeded.

8.5 Parallel and Series Operation

Because of the absence of an active current sharing feature, parallel operation of multiple EXQ125 converters is generally not allowed. If unavoidable, ORing diodes must be used to decouple the outputs. Droop resistors will support some passive current sharing. It should be noted that both measures will adversely affect power conversion efficiency.

Outputs of multiple EXQ125 converters can be connected in series. However, it is possible in certain connections that the common-mode EMI levels may increase. It is therefore advisable to contact your local Artesyn Technologies representative for further information on this issue.
8.6 Output Capacitance
EXQ125 series dc-dc converters are designed for stable operation without the need for external capacitance at their output terminals. However, when powering loads with large dynamic current requirements, improved voltage regulation can be obtained through the use of such capacitance. The most effective technique is to fit low ESR ceramic capacitors as closely to the load as possible, using several capacitors to lower the overall ESR. These ceramic capacitors will handle the short duration high frequency components of the dynamic current requirement. In addition, higher value electrolytic capacitors should be used to handle the mid-frequency components.

It is equally important to use good design practices when configuring the dc distribution system. As outlined in section 8.1, low resistance and low inductance PCB layout traces should be utilized, particularly in the high current output section. Remember that the capacitance of the distribution system and the associated ESR are within the feedback loop of the power module. This can have an effect on the module compensation and the resulting stability and dynamic response performance. Generally, as a rule of thumb, 100 µF/A of output current can be used without any additional analysis. With larger values of capacitance, the stability criteria depend on the magnitude of the ESR with respect to the capacitance. As much of the capacitance as possible should be outside of the remote sensing loop and close to the load.

Note that the maximum rated value of output capacitance for models with output voltages up to and including 3.3 V is 10,000 µF. Higher voltage models will have reduced capacitive load rating. If required, larger capacitance values are possible; please contact your local Artesyn Technologies representative for further information.

8.7 Reflected Ripple Current and Output Ripple & Noise Measurement
The measurement set-up outlined in Figure 20 has been used for both input reflected/terminal ripple current and output voltage ripple and noise measurements on EXQ125 series converters. When measuring output ripple and noise, a 50 Ω coaxial cable with a 50 Ω termination should be used to prevent impedance mismatch reflections disturbing the noise readings at higher frequencies. The input ripple current measurement setup is compatible with ETS 300 386-1.

Note that the maximum rated value of output capacitance for models with output voltages up to and including 3.3 V is 10,000 µF. Higher voltage models will have reduced capacitive load rating. If required, larger capacitance values are possible; please contact your local Artesyn Technologies representative for further information.

8.8 Compatibility with ADM1070 Hot Swap Controller
Inserting circuit boards into a live -48 V backplane can cause large input transient currents when large capacitances are charged. These transient currents can cause glitches on the system power supply and permanently damage components on the board. To ensure that the input voltage is stable and within tolerance before being applied to the dc-dc converter, Artesyn Technologies recommends the use of a hot-swap controller, such as the ADM1070 from Analog Devices. This device controls harmful transient currents and ensures safe insertion or removal of the application board from a live backplane.

The ADM1070 is a 6-pin SOT-23, negative voltage hot-swap controller that allows a board to be safely inserted and removed from a live backplane. This product is compatible with the EXQ125 family. The ADM1070 provides the following features:

- Inrush current is limited to a programmable value by controlling the gate voltage of an external N-channel pass transistor
- The pass transistor is turned off if the input voltage is less than the programmable under-voltage threshold or greater than the over-voltage threshold. A programmable electronic circuit breaker protects the system against shorts.

The UV/OV pin can be used to detect undervoltage and overvoltage conditions at the power supply input. The EXQ125 already has in-built undervoltage protection to ensure that the unit does not draw power from the source for voltages less than approximately 30 V. Users should refer to the data sheet of the ADM1070 for details on setting the required UVLO and OVLO trip levels.

The ADM1070 features a current limiting function that protects against short circuits or excessive supply currents. The flow of current through the load is monitored by measuring the voltage across the sense resistor, \( R_{\text{sense}} \). The action taken by the controller in the event of an input over-current condition will depend upon the severity of that condition. Please refer to the ADM1070 product datasheet on www.analog.com for details.
Appendix 1 - Recommended PCB Footprints

**VIEW IS FROM TOP SIDE**

- Top Side (Layer 1 of 2)
  - +Vin
  - -Vin
  - Ground
  - Thermal Reliefs

- Bottom Side (Layer 2 of 2)
  - +Vout
  - -Vout
  - Ground
  - Thermal Reliefs
  - 0.060 (1.52) Min Clearance

**THERMAL RELIEF IN CONDUCTOR PLANES**
REFERENCE IPC-D-275 SECTION 5.3.2.3

**ALL DIMENSIONS IN INCHES (mm)**
**ALL TOLERANCES ARE ±0.10 (0.004)**

*Figure 26 - Recommended Footprints*